AMENDED CLAIMS

[Received by the International Bureau on 23 November 2005 (23.11.05) original claims 1, 4, 14, 17 and 20-31 amended; remaining claims unchanged (4 pages)].

1. A counter current mixing reactor for continuously mixing two or more fluids of differing densities comprising a first inlet and an outlet characterised in that one or more further inlets are diametrically opposed to the first inlet and are disposed within the outlet, wherein at least one of the fluids is in the sub critical, near critical or supercritical state.

2. A mixing reactor as defined in claim 1 comprising a first inlet and an outlet characterised in that a further inlet is diametrically opposed to the first inlet and is disposed within the outlet.

3. A mixing reactor as defined in claim 1 or claim 2 arranged in a vertical configuration.

4. A mixing reactor as defined in any preceding claim wherein at least one of the fluids is heated, pressurised or supercritical water.

5. A mixing reactor as defined in claim 4 wherein the fluid of lower density is kept hot using a heater around the outlet.

6. A mixing reactor as defined in any of claims 1 to 5 wherein at least one of the fluids is a solution of a metal salt or compound.

7. A mixing reactor as defined in claim 6 wherein at least one of the fluids is an aqueous solution of a metal salt or compound.

8. A mixing reactor as defined in claim 7 wherein the aqueous solution is an aqueous metal salt solution of the metals selected from transition metals including ruthenium, cadmium, rhodium, palladium, iron, cerium, titanium, zirconium, copper and silver.

9. A mixing reactor as defined in any of claims 1 to 8 wherein the fluid of higher density is cooler than the fluid of lower density.

10. A mixing reactor as defined in claim 9 wherein the fluid of higher density is cooled using a heat sink.

11. A mixing reactor as defined in any of claims 1 to 10 wherein the one or more further inlets comprise a shaped nozzle, for example, a conical funnel.

12. A mixing chamber comprising one or more mixing reactors as defined in any of claims 1 to 11 arranged in series.

13. A process for preparing metal or metal oxide nanoparticles which comprises delivery of a metal salt solution through a first inlet of a mixing reactor as defined in any of claims 1 to 11 and delivery of a fluid in the sub critical, near critical or supercritical state through a further inlet diametrically opposed to the first inlet wherein said further inlet is disposed within an outlet such that the mixed solutions exit the reactor once mixed.

14. A process for preparing metal or metal oxide nanoparticles which comprises mixing a solution of supercritical water with an aqueous metal salt solution, characterised in that the aqueous metal salt solution is cooled prior to mixing.

15. Metal or metal oxide nanoparticles obtainable by a process as defined in claim 13 or claim 14.

16. A device capable of mixing two fluids of differing densities having a downwardly facing outlet for less dense fluid and inlet for more dense fluid adapted to cause an upwards flow of the more dense fluid in use, the arrangement being such that the less dense fluid is introduceable into the device in a downwards orientation relative to the upwards flow of the denser fluid.

17. A device as specified in claim 16, characterised by the inlet of the less dense fluid having a conical nozzle to aid mixing of the fluids.

18. A device as specified in claim 16 or claim 17 in which the denser of the two solutions is cooled prior to entry into the reactor.

19. Fluid mixing apparatus in which two or more devices specified in any of claims 16 to 18 are used in series.

20. Use of the device of any one of claims 1 to 19 to mix two fluids of differing densities such that the mixing occurs within the device.

21. Use as claimed in claim 20 in which one or both fluids is/are in the near critical or supercritical state.

22. Use as claimed in claim 20 or claim 21, in which one of the fluids is near-critical or supercritical water.

23. Use as claimed in any of claims 20 to 22, in which one of the fluids is an aqueous salt solution.

24. Use as claimed in any of claims 20 to 23, in which the device of claims 16 to 19 is used in the synthesis of metal nanoparticles.

25. Use as claimed in claim 24 in which the device of claims 16 to 19 is used to produce nano-particulate cerium oxide.

26. Use as claimed in claim 24 in which the device of claims 16 to 19 is used to produce nano-particulate titanium oxide.

27. Use as claimed in claim 24 in which the device of claims 16 to 19 is used to produce nano-particulate zirconium oxide.

28. Use as claimed in claim 24 in which the device of claims 16 to 19 is used to produce nano-particulate copper oxide.

29. Use as claimed in claim 24 in which the device of claims 16 to 19 is used to produce nano-particulate silver oxide.

30. Use as claimed in claim 24 in which the device of claims 16 to 19 is used to produce mixed metal oxides, specifically mixed copper and zinc oxides.

31. A process for continuously mixing two or more fluids of different densities comprising delivering a first fluid in a first direction of flow and delivering of one or more further fluids in a second direction of flow diametrically opposed to the first direction of flow so that the fluids mix at a mixing region the mixed fluids being carried away from the mixing region by the flow of one of the fluids, and wherein at least one of the fluids is in the subcritical, near critical or supercritical state.